VISIBLE-NEAR-INFRARED REFLECTANCE SPECTROSCOPY OF ORDINARY CHONDRITE METEORITES UNDER SIMULATED ASTEROID SURFACE CONDITIONS. M. E. Gemma[1,2,3], K. A. Shirley[4], T. D. Glotch[4], D. S. Ebel[2,1,3], [1]Department of Earth and Environmental Sciences, Columbia University, New York, NY, 10027, [2]American Museum of Natural History, New York, NY, 10024, [3]Lamont-Doherty Earth Observatory, Palisades, NY, 10964, [4]Department of Geosciences, Stony Brook University, Stony Brook, NY, 11794.

Introduction: Recent missions have revealed much about the nature of many near-Earth asteroids, including the NEAR-Shoemaker target 433 Eros and Hayabusa target 25142 Itokawa. Both asteroids appear to have mineralogy consistent with ordinary chondrite meteorites [1,2]. Laboratory spectral analysis of well-constrained meteorite samples can be employed as a reference tool to characterize and constrain data from current and future asteroid studies.

Methods: A sample set of ordinary chondrite meteorites was chosen from the collection at the American Museum of Natural History. Six meteorites, spanning groups H, L, and LL, were prepared at four different size fractions (25-63 µm, 63-90 µm, 90-125 µm, 125-250 µm) in an attempt to mimic regolith known to exist on asteroids such as 433 Eros and 25142 Itokawa. At the Center for Planetary Exploration at Stony Brook University, spectra of the ordinary chondrite material were measured under simulated asteroid surface conditions (~10^{-6} mbar, 170 K chamber temperature, low intensity illumination). The samples were used to measure visible and near-infrared (VNIR) reflectance spectra at a series of temperatures. Reflectance spectra were collected in increments of 10 K, over the range 283.15 K to 373.15 K.

Results: The resulting VNIR spectra show minimal spreads due to temperature changes for simulated near-Earth asteroid conditions. The spectral changes due to sample grain size are systematic and expected, and the absorption maximum for this material lies in the 63-125 µm grain size range. The degree of petrologic alteration of an ordinary chondrite meteorite sample has a pronounced effect on its spectra. Meteorite samples that experienced minimal petrologic alteration (Jilin (H5), Soko-Banja (LL4), and the 25-63 µm size fraction of Mount Tazerzait (L5)) have consistently shallower band depths than their more petrologically altered partners from the same ordinary chondrite group (Zhovtnevyi (H6), Mangwendi (LL6), and the 25-63 µm size fraction of Suizhou), possibly due to differences in metal content (Figure 1). Experimental studies such as this one will enhance interpretation of current and future planetary remote sensing data sets. This work is part of an effort to develop a comprehensive spectral library of materials relevant to airless bodies and future missions such as OSIRIS-REx and Hayabusa2.

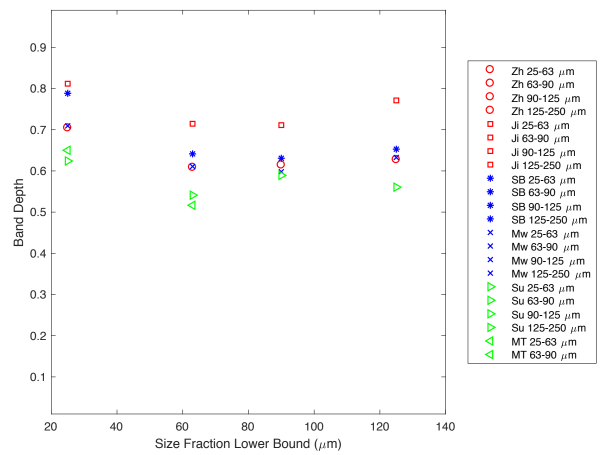

Figure 1. Band Depth vs. Size Fraction plotted for the ordinary chondrite meteorite samples. Markers of the same color are from the same ordinary chondrite group (red = H chondrites, blue = LL chondrites, green = L chondrites). The x-axis coordinate of each point represents the lower bound of the size fraction for that measurement. Each point represents the band depth average of the temperature series for a particular size fraction. Samples with a lower degree of petrologic alteration tend to have a shallower band depth than their group counterpart. Data is missing for the two largest size fractions of the Mt. Tazerzait meteorite.

References: [1] Nakamura T. et al. (2011). Science, 333(6), 1113–1116. [2] Trombka J. I. et al. (2000). Science, 289(5), 2101–2105.